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**(72) Inventors:**

- **Spink, Kenneth M.**  
**Jerome Michigan 49249-9517 (US)**
- **Bergsma, Rudolph**  
**Ann Arbor Michigan 48103-6111 (US)**

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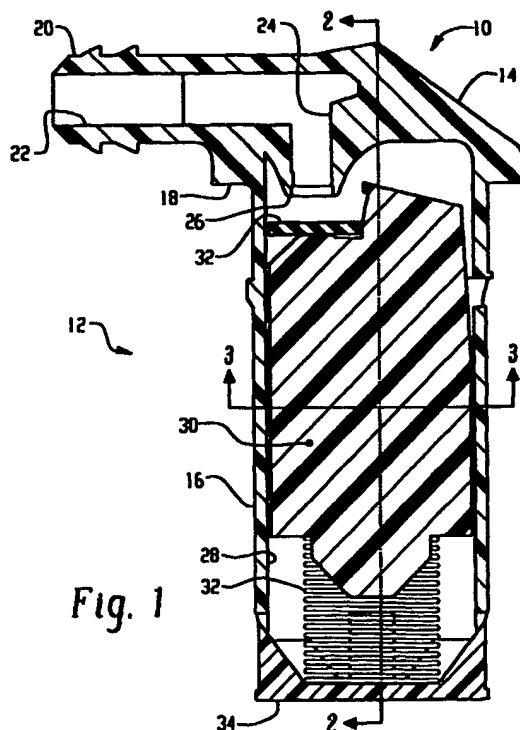
**(74) Representative:**  
**Patentanwälte Rüger, Barthelt & Abel**  
**Webergasse 3**  
**73728 Esslingen (DE)**

(71) Applicant: **EATON CORPORATION**  
Cleveland, Ohio 44114-2584 (US)

**(54) Fuel vapor vent valve and method of attaching same to a tank**

(57) A float operated fuel vapor vent valve has body structure with an annular mounting flange (18) formed of material weldable to a fuel tank and the flange is spin welded to the tank. The float has surfaces (40,42) thereon which slidably engage corresponding surfaces

(36,38) in the float chamber (28) to prevent relative rotation of the float (30) with respect to the valve body (12) during spin welding. An optional pressure relief valve (88) in the vent outlet also has surfaces slidably engaging the vent passage to prevent relative rotation during spin welding.



*Fig. 1*

## Description

### BACKGROUND OF THE INVENTION

[0001] The present invention relates to fuel vapor vent valves employed in vapor emission controls systems in motor vehicle fuel tank installations. The invention particularly relates to float operated vent valves attached to the upper wall of a non-metallic fuel tank. Valves employed for such applications are commonly mounted onto the tank through an access opening formed in the upper wall with portions of the valve extending outwardly over the opening and attached to the outer surface of the tank in a sealing arrangement, as for example, by weldment of compatible non-metallic material to the surface of the tank.

[0002] Heretofore the weldment has been by hot-plate or sonic welding techniques which have proven relatively costly in mass production. Heretofore, attempts to spin weld a fuel vapor vent valve of the present type have resulted in destruction of the valving surfaces by the extreme rotational accelerations and decelerations. Furthermore, proper or accurate orientation of the vent hose connector was not possible with spin welding. However, spin welding has been desired as a more cost effective way of attaching the vent valve to the tank than hot-plate or sonic welding.

### BRIEF SUMMARY OF THE INVENTION

[0003] The present invention provides a float operated vapor vent valve for a fuel tank which may be assembled through an access opening formed in the upper wall of the tank with the float operated valve extending interiorly of the tank and a vent port connection extending exteriorly of the tank. The valve has a flange formed of material compatible for welding to the outer surface of the tank to effect a permanent sealing attachment thereon. The float is slidably movable in the float chamber and has surfaces thereon engaging the wall of the float chamber to prevent relative rotation of the float valve member with respect to the valve body. The slidable rotary float constraint enables spin welding of the flange to the tank without loss of calibration or damage to the valve components. An optional gravity operated pressure relief valve may be incorporated in the vent passage; and, the relief valve also has surfaces thereon slidably engaging the wall of the vent passage to prevent relative rotation of the relief valve poppet during spin welding.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 is a cross section of a valve employing the present invention;

[0005] FIG. 2 is a sectional view taken along section indicating line 2-2 of FIG. 1;

[0006] FIG. 3 is a section view taken along section in-

dicating line 3-3 of FIG. 1;

[0007] FIG. 4 is a cross section of an alternate embodiment of the invention shown mounted through an access opening in a fuel tank;

[0008] FIG. 5 is a section view taken along section indicating line 5-5 of FIG. 4; and

[0009] FIG. 6 is a section view taken along section indicating line 6-6 of FIG. 4.

### 10 DETAILED DESCRIPTION OF THE INVENTION

[0010] Referring to FIG. 1, a valve assembly indicated generally at 10 has a unitary or one piece body indicated generally at 12, formed with an upper or exterior portion 14 with an annular mounting flange 18 and a lower portion 16 intended for extending interiorly of the tank. The upper portion has a fitting 20 provided thereon with a vent passage 22 formed therein; and, fitting 20 is adapted for having a flexible hose received thereon for connection thereto. Passage 22 communicates with a downwardly extending passage 24 which has a valve seat 26 formed at the lower end thereof.

[0011] The lower portion 16 of the body has a float chamber 28 formed therein into which is received a float member 30 with a resiliently flexible valve member in the form of a pivoted flapper pad or disk 32 disposed on the upper end of the float 30 for movement therewith.

[0012] The float 30 is biased upwardly by a spring 32 with one end registered against the lower end of the float 30 and the opposite end of the spring 32 registered against an end cap or closure member 34 secured in the lower end of the float chamber 28. The spring is calibrated to provide the desired buoyancy force in the fuel to be used in a known manner. It will be understood that when the fuel level in the tank rises to a certain level, upward movement of float 30 causes valve member 32 to close against valve seat 26.

[0013] Referring to FIGS. 2 and 3, the float 30 has at least one and preferably a plurality of oppositely disposed engagement surfaces in the form of longitudinal grooves 36, 38 formed therein; and, the wall of the float chamber 28 has correspondingly configured engagement surfaces in the form of projections 40, 42 provided thereon which slidably engage the grooves 36, 38 respectively. Upon spin welding of the body flange 18 onto the fuel tank the sliding engagement of the projections 40, 42 with the grooves 36, 38 prevents relative rotation of the float with respect to the body and thus prevents damage to the float and valve member and any deleterious effects on the calibration of the float spring 32.

[0014] Referring to FIGS. 4, 5 and 6, another embodiment of the invention indicated generally at 50 is illustrated and includes a body 52 having a float chamber 54 formed therein with a float assembly indicated generally at 56 slidably received therein and retained by a cap or closure 58 attached to the lower end of the body. The float assembly 56 includes a resilient valve member 60 disposed and captured on the upper end of the float

56.

[0015] The upper end of the body is attached to a cover member 62 which is disposed exteriorly of the wall of a fuel tank 64 with portions thereof extending through an access opening 66 formed in the tank wall 64. The cover 62 has an annular flange 68 extending outwardly of the access opening 66 and which is retained and sealed on the outer surface of the tank wall 64 by spin welding.

[0016] The upper end of the body defines a vent passage 70 having a valve seat 72 associated therewith which is disposed vertically in line with the valve member 60, and, valve seat 72 is closed by valve member 60 upon upward movement of the float when the fuel level rises to a level causing the float to close the valve. Vent passage 70 communicates with an upward passage 74 which communicates with a vent outlet 76 formed in a fitting 78 adapted for receiving an end of a hose thereover.

[0017] The body 52 is attached to the cover 62 by snap locking of barbs 80 into apertures or recesses 81 formed in the cylindrical portion 82 of the cover which extends downwardly through the access opening 66.

[0018] The upper end of the body 52 is attached and secured to the cover by a labyrinth seal indicated generally at 84; and, the assembly of the body 52 and the cover 62 is attached to the upper surface of the tank 64 by spin welding.

[0019] Referring to FIG. 5, the float assembly 56 has at least one and preferably a plurality of engagement surfaces in the form of longitudinally extending grooves 84 formed therein which are slidably engaged with a correspondingly disposed pair of engagement surfaces or guides 86 formed on the inner periphery of float chamber 54.

[0020] Referring to FIGS. 4 and 6, a gravity operated pressure relief valve member 88 is slidably disposed in the passage 75 formed as a counter bore on the upper end of vent passage 70, with a valving surface 90 formed on the lower end thereof for seating against the upper end of the vent passage 70. The valve member 88 has a plurality of projections or engagement surfaces 92, 94, preferably formed by cross pins, which are slidably received in the slot 96 formed in the upper end of the body 52. The engagement of pins 92, 94 with the slot 96 prevents rotation of the valve member 88 during spin welding.

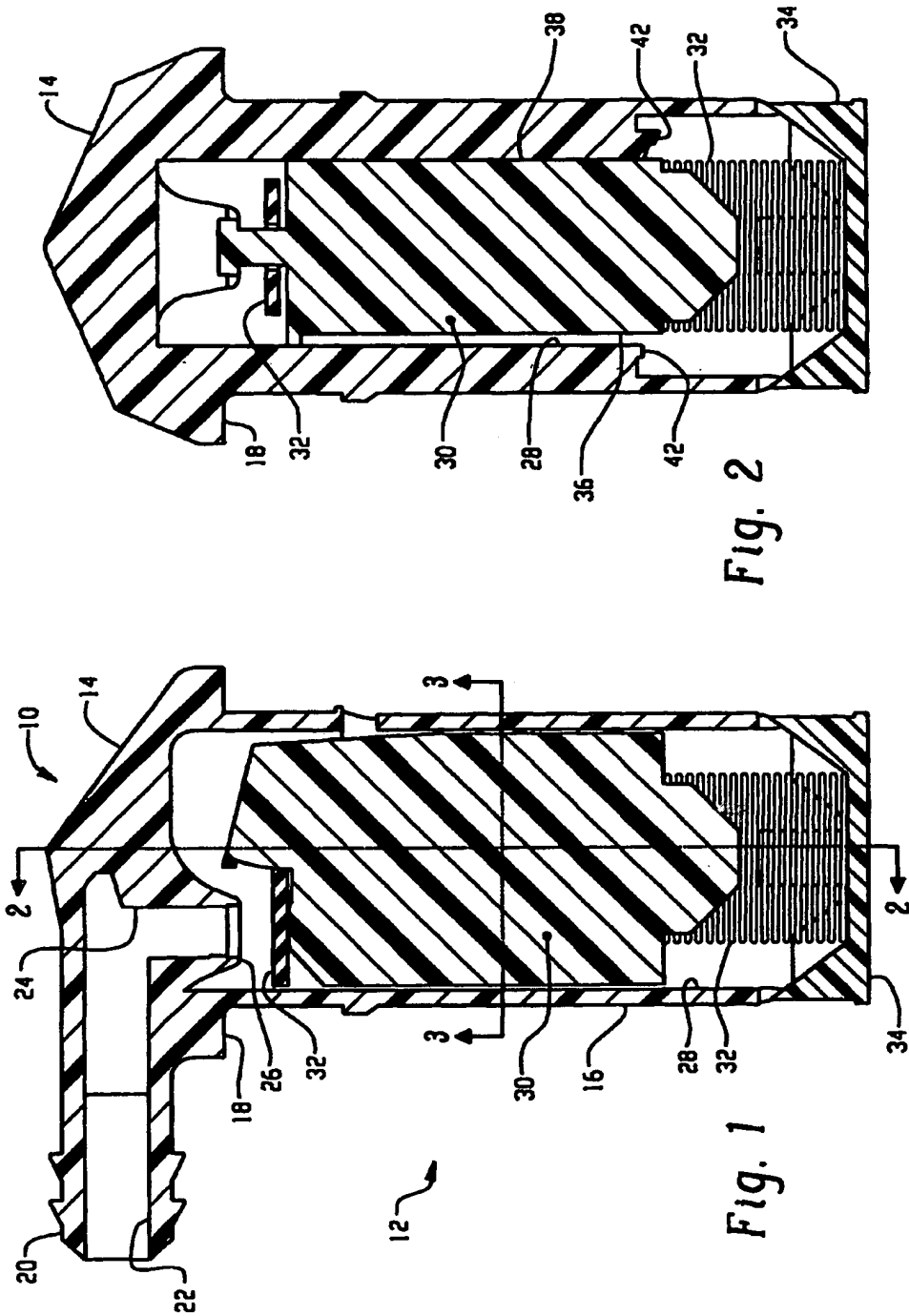
[0021] The present invention thus provides for spin welding attachment of a fuel vapor vent valve to the exterior surface of a fuel tank which eliminates the need for a heating device for welding. The invention permits spin welding without disturbing the interior components and calibration of the vapor vent valve during spinning. The valve of the present invention includes surfaces on the float and on an optional gravity pressure relief valve which slidably engage corresponding surfaces on the valve body to prevent relative rotation of the respective parts during the spin welding operation.

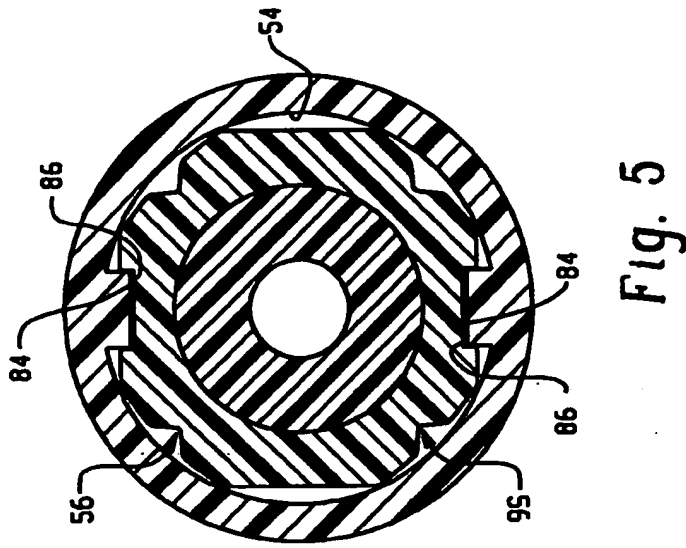
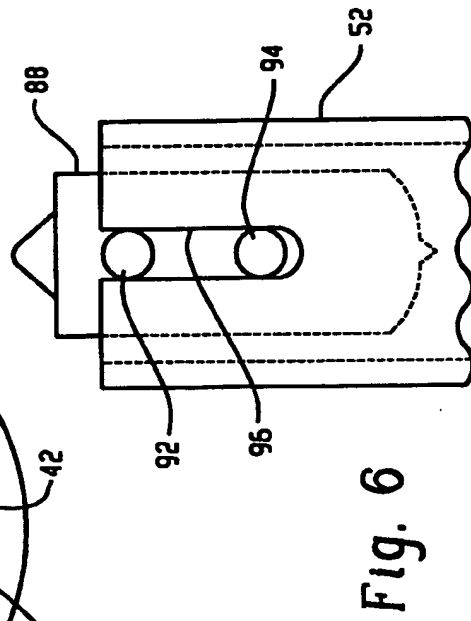
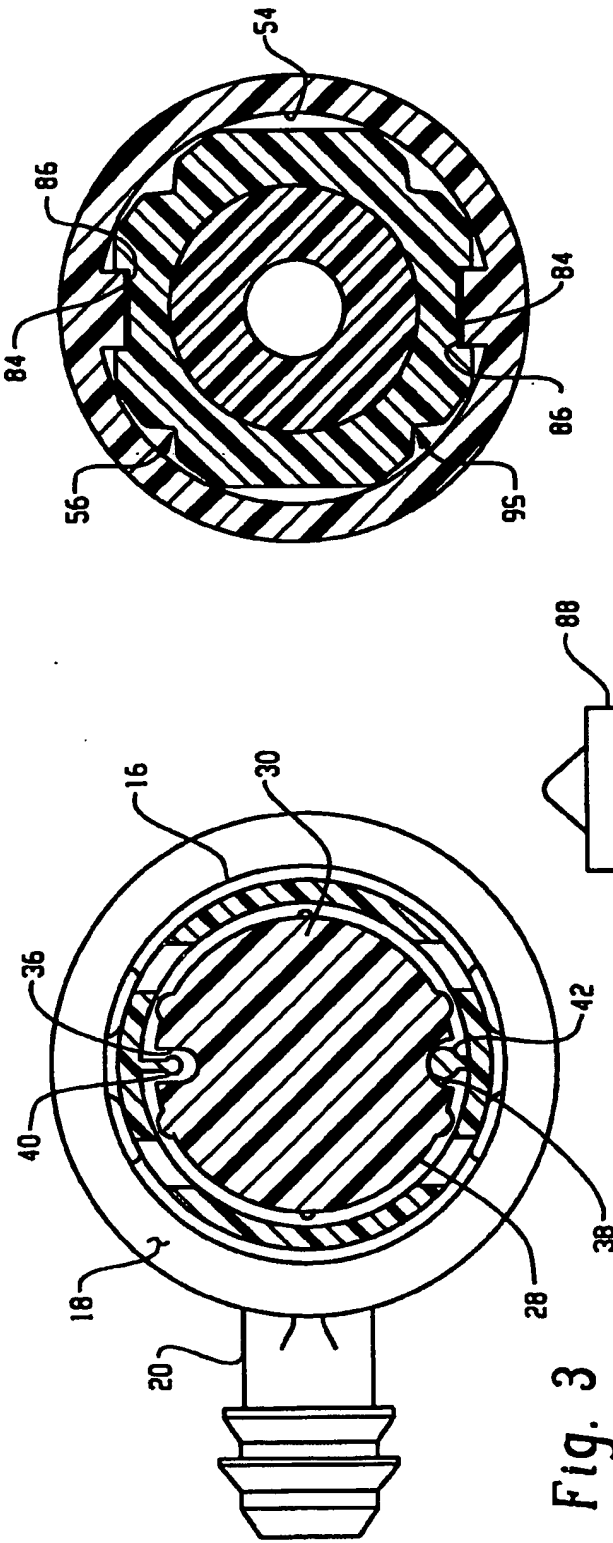
[0022] Although the invention has hereinabove been described with respect to the illustrated embodiments, it will be understood that the invention is capable of modification and variation and is limited only by the following claims.

#### Claims

1. A method of mounting a float operated vapor vent valve through an access opening to a fuel tank comprising:
  - (a) forming a valve body (12) with a flange (18, 68) of weldable material and having a float chamber (28, 54) and disposing a float (30, 56) therein and forming a vent port (24, 74) with a float valve (26, 60) communicating with the float chamber;
  - (b) disposing a valve member (26) for movement with the float and moving the float and seating the valve member on said valve seat and closing the vent port;
  - (c) forming co-operating surfaces (18, 86) on said float chamber (36, 84) and said float and slidably engaging said surfaces and preventing relative rotation therebetween;
  - (d) inserting portions of said body through an access hole (66) in the tank; and,
  - (e) spin welding said flange to the tank.
2. The method defined in claim 1, wherein said step of forming a body includes forming an annular flange (62) extending outwardly over said access opening.
3. The method defined in claim 2 wherein said step of slidably restraining includes forming a pair of oppositely disposed slots (96) and forming projections (92, 94) on the valve member and disposing the projections in said slot.
4. The method defined in claim 1 wherein said step of forming cooperating surfaces on said body chamber and said float includes forming a plurality of ribs on one of said chambers and said float and forming corresponding grooves on the other.
5. The method defined in claim 1, further comprising disposing a gravity operated pressure relief valve (88) in said vent port downstream of said float valve seat.
6. The method defined in claim 5 wherein said step of disposing a pressure relief valve includes slidably disposing an obturator and preventing rotation thereof with respect to said body.

7. The method defined in claim 6 wherein said step of preventing rotation includes forming a plurality of slots and engaging the slots with cooperating surfaces on said obturator.  
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8. The method defined in claim 7 wherein said step of engaging the slots includes disposing a cross pin in said pressure relief valve.  
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9. The method defined in claim 1, wherein said step of forming a valve body includes forming a body of non-weldable material and attaching a cover of weldable material with the flange portion thereon.  
15
10. A float operated vapor vent valve for mounting through an access opening in a fuel tank and weldment to the tank:  
20
  - (a) a valve body (12, 50) formed of material with a flange portion (18, 62) weldable to the tank and having a valving cavity (28, 80) therein with a vent passage having a valve seat;  
25
  - (b) a float (30, 56) disposed in the valving cavity and having a valve member (26, 60) thereon moveable with the float for closing against said valve seat;  
30
  - (c) said flange portion extends outwardly over the access opening and is spin welded to the tank; and,
  - (d) said float includes surfaces (84) thereon engaging cooperating surfaces (18, 86) in said valving chamber for preventing relative rotation therebetween during spin welding.  
35
11. The combination defined in claim 10, wherein said cooperating surfaces include ribs on one of said float and valving chamber and grooves on the other.  
40
12. The combination defined in claim 10, further comprising a gravity operated pressure relief valve (88) disposed in said vent chamber downstream of said vent valve seat.  
45
13. The combination defined in claim 12, wherein said pressure relief valve includes another valve seat (70) and an obturator (88) moveable with respect thereto.  
50
14. The combination defined in claim 12, wherein said pressure relief valve includes another valve seat and an obturator moveable with respect thereto and anti-spin means (92, 94, 96) operable to prevent relative rotation between said obturator and said another valve seat during spin welding.  
55
15. The combination defined in claim 14, wherein said anti-spin means includes a slot (96) in said body slidably engaged by a projection (92, 94) on said obturator.  
60
16. The combustion defined in claim 15, wherein projection includes a cross pin (92, 94) in said obturator.  
65
17. The combination defined in claim 10, wherein said cover seal on said body includes an annular labyrinth seal (84).  
70
18. The combination defined in claim 10, wherein said body is formed of non-weldable material and has a cover of weldable material with said flange attached thereto.  
75





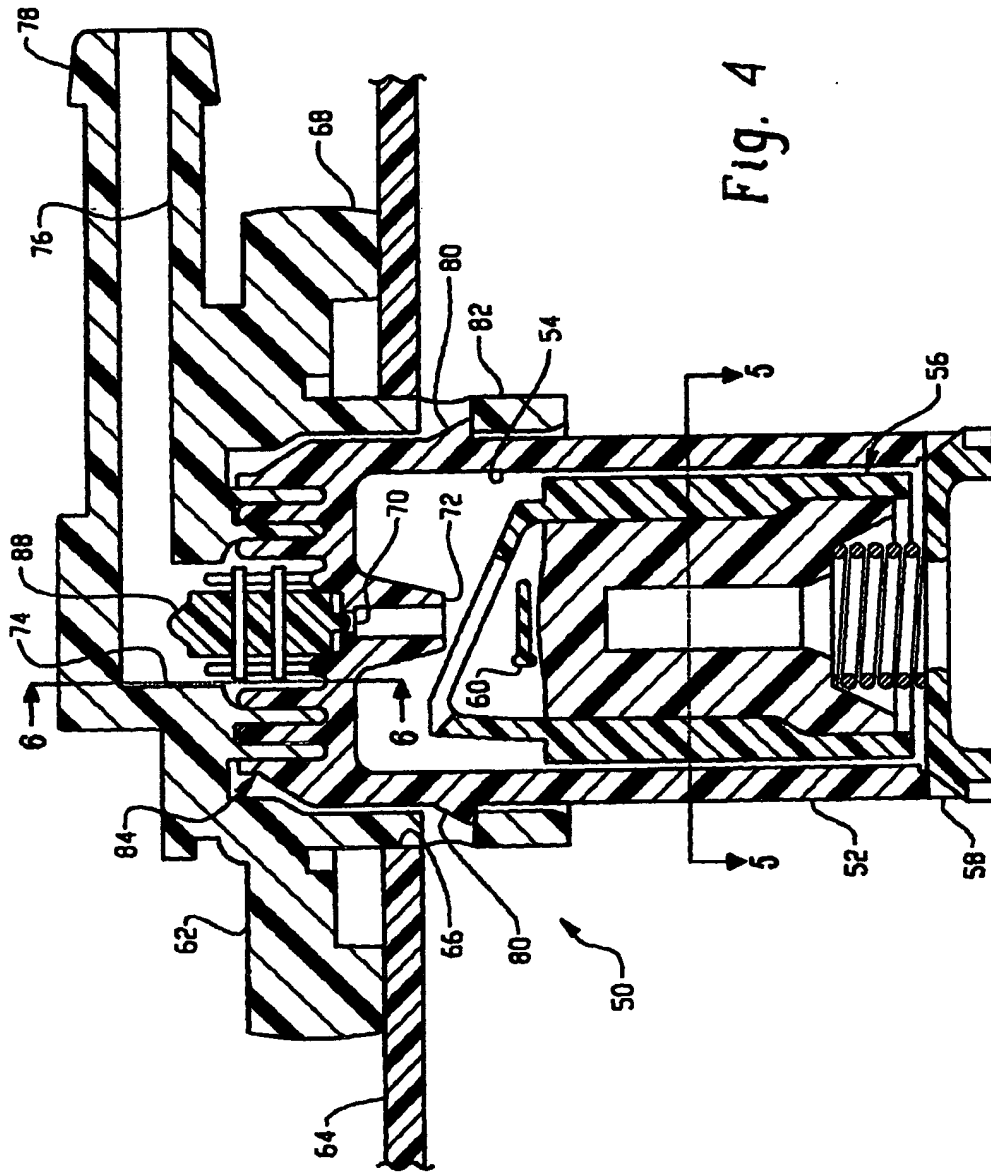


Fig. 4



European Patent  
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## EUROPEAN SEARCH REPORT

Application Number  
EP 04 02 0737

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 6 206 057 B1 (BENJEY ROBERT P ET AL) 27 March 2001 (2001-03-27) * column 2, line 44 - column 7, line 28; figures 2,3 *	1,2,4,5, 9-12	F16K24/04
Y	US 6 025 086 A (CHING LARRY K W) 15 February 2000 (2000-02-15) * abstract; figure 7 *	1,2,4,5, 9-12	
A	US 5 404 907 A (BELANGER PETE ET AL) 11 April 1995 (1995-04-11) * figures *	1-19	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F16K B29C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 October 2004	Examiner Rusanu, I
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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ON EUROPEAN PATENT APPLICATION NO.**

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07-10-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6206057	B1	27-03-2001	US 6062276 A 16-05-2000
		US 5860458 A 19-01-1999	
		US 5590697 A 07-01-1997	
		US 5983958 A 16-11-1999	
		CA 2198008 A1 29-02-1996	
		DE 69515122 D1 23-03-2000	
		DE 69515122 T2 14-12-2000	
		DE 69525070 D1 21-02-2002	
		DE 69525070 T2 05-09-2002	
		EP 0777833 A1 11-06-1997	
		EP 0845624 A2 03-06-1998	
		JP 10506696 T 30-06-1998	
		JP 3150702 B2 26-03-2001	
		WO 9606294 A1 29-02-1996	
		US 5755252 A 26-05-1998	
		US 5797434 A 25-08-1998	
US 6025086	A	15-02-2000	US 5856037 A 05-01-1999
US 5404987	A	11-04-1995	NONE

EPO FORM P0459

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